sicians are sometimes criticized for not making definite diagnoses in connection with obscure conditions affecting school children. The public forgets that private physicians in similar cases only make a diagnosis after a complete physical examination, together with most exhaustive laboratory investigations. School physicians, from the nature of their work and experience, become expert in observing the normal growth and development of children. They are alert to detect slight deviations from normal, the earliest symptoms of physical abnormality or disease. In such cases only time or the complete laboratory service at the disposal of the family physician or clinic will elucidate the diagnosis. The school physician is not in the school to take the place of either the family physician or the clinic physician; he is there to guide the children along the road to health. Along this road the family physician and dentist are exceedingly important in providing personal supervision of health and physical rehabilitation by treatment when necessary.

Chenoweth and Selkirk have admirably analyzed the situation as follows: "The school examination aims not at making diagnoses, but at pointing out the need for medical supervision when necessary. Its purpose is not to provide advice as to treatment even for the indigent class, since this consumes too great an amount of time and is more efficiently handled by other means. The health examination is essentially an effort in health education to establish suitable attitudes in the child and his parents, and to act as a motivating force for healthful living. By the school examination, however, masses of children are examined who would otherwise be passed by, a multitude of defects are discovered which would otherwise pass unnoted, and correction is instituted in vast numbers of cases." [2]

Physical Findings of Physicians of Value to the Classroom Teacher.—A great deal of the value of the school physical examination may be lost if the information obtained by the school physician is not made available to the teachers. Every effort should be made through health coördinators, or someone functioning in that capacity, to see that the findings of the school physicians are passed on to the classroom teacher. Defects of vision, hearing, heart, and malnutrition, etc., create classroom situations and problems which can only be handled intelligently when the information obtained by the physician is made available to the teachers.

Chamber of Commerce Building.
C. MORLEY SELLERY,
Los Angeles.

2 Chenoweth and Selkirk: School Health Problems, p. 155. F. S. Crofts & Co., Inc., New York, 1937.

In these days, half our diseases come from the neglect of the body in the overwork of the brain. In this railway age the wear and tear of labor and intellect go on without pause or self-pity. We live longer than our forefathers; but we suffer more from a thousand artificial anxieties and cares. They fatigued only the muscles—we exhaust the finer strength of the nerves.—Bulwer.

With stupidity and sound digestion men may fret much; but what in these dull unimaginative days are the terrors of conscience to the diseases of the liver.—Carlyle.

ORIGINAL ARTICLES

PROBLEMS IN THE DIAGNOSIS OF ACUTE APPENDICITIS*

By THOMAS O. BURGER, M. D.
AND
HAROLD C. TORBERT, M. D.
San Diego

DISCUSSION *by E. H. Eiskamp, M. D., Watsonville; John Homer Woolsey, M. D., Woodland.*

FAILURE to diagnose acute appendicitis promptly and correctly was the subject of the chairman's address by the senior author[1] before the Section on General Surgery of the California Medical Association in 1926. A review of 449 cases of acute appendicitis seen in our practice during the past ten years offers unhappy evidence that surgical intervention is still too often delayed by faulty diagnosis. The seriousness of a situation which results in high mortality rates during so recent a period indicates vividly the need for continued attention by the profession to this whole matter. It is our purpose, therefore, to review in some detail the results of our study of the ten-year case series, in the hope of pointing out some of the pitfalls actually encountered in day-to-day practice.

CLINICAL MATERIAL FOR THIS STUDY

Of the 449 cases, all but three were proved by histological examination. In the three exceptions, operation was limited to drainage of abscesses without removal of the ruptured appendix.

In 129 cases, or 26.9 per cent of the series, the appendix was ruptured at the time of operation. Thirty patients died, a mortality rate for the series of 6.7 per cent. Twenty-six of the thirty deaths occurred among the 129 patients with ruptured appendices, a mortality rate for this group of 20.2 per cent. Among 320 unruptured cases there were four deaths, a mortality rate of 1.25 per cent. Actually, only one of these four deaths, a case of pulmonary embolism occurring in a thirty-eight-year-old male, can fairly be attributed to the operation. The remaining three deaths were due to the following causes: Myocardial failure in a man, seventy-nine; cerebral hemorrhage in a woman, sixty-seven years old; and suicide on the tenth day of an uncomplicated postoperative course by a forty-six-year-old male. Nevertheless, taking the uncorrected figures as they stand, the contrast is impressive enough.

Obviously the referring physicians were not responsible for all delayed and ruptured cases. Too familiar is the patient who has been ill three, four, or more days before he calls his family doctor. Equally familiar is the patient, or family, who refuses surgery, or delays accepting it until many days have passed. Furthermore, there are cases in which the morbid process is so fulminating that the appendix ruptures before the promptest of diagnoses and intervention can take place.

* Read before the General Surgery Section of the California Medical Association at the sixty-seventh annual session, Pasadena, May 9–12, 1938.

TABLE 1.—*Showing the Number of Patients Complaining of the Classical Symptoms of Acute Appendicitis*

Symptom	Number of Patients Presenting Symptom	Percentage of Total Number of Patients
Nausea	305	64.5
Vomiting	211	48.1
Epigastric discomfort	138	31.4
Generalized abdominal pain	250	56.9
Localized pain	408	92.9
Not stated	10	

RESPONSIBILITY OF THE PHYSICIAN

But after all cases of patient error have been eliminated, there remain such a large number of instances of delay or failure in diagnosis on the part of the physician as to constitute a serious challenge to every thoughtful medical man. As Monte Reid points out in a recent editorial published after this paper was prepared[2], responsibility must rest squarely on the shoulders of every medical man who temporizes with this disease, in view of the known striking difference in the mortality and morbidity of delayed, as contrasted with early operation. We say medical man advisedly, because, although surgeons are not free of error, it is usually the family doctor or internist who first sees the patient. Upon him, therefore, rests the primary responsibility of making the diagnosis, or at least of suspecting it, and obtaining adequate surgical advice.

SO-CALLED CLASSICAL SYMPTOMS

Every physician is familiar with the diagnostic constellation of generalized abdominal pain shifting to the right lower quadrant, with nausea, vomiting, point tenderness, muscle rigidity, moderate elevation of pulse rate and temperature, and increased leukocyte count, chiefly in the polymorphonuclear neutrophiles. However, the record seems to show that many are not familiar with the fact that, as Finney[3] puts it, "all of these things are present in a few cases, a few of them are present in the majority of cases, and virtually none of them are present in quite an appreciable number of cases." (Table 1.)

Table 1 shows that no single one of the so-called "classical" symptoms was present in every case. The most constant finding was localized pain, present in 92 per cent. Finney also found this to be one of the most consistently reliable symptoms. Tables 2 and 3 show the errors into which dependence on any single sign, such as fever or elevated blood count, will lead the diagnostician. Our records lead us to agree with other writers that a relative increase in polymorphonuclear neutrophiles is a more constant finding than is elevation of the total white count. Physical examination proved somewhat more reliable than either history or laboratory examination, 399, or 88.9 per cent of the cases exhibiting signs which were interpreted as positive for acute appendicitis. (Tables 2 and 3.)

TABLE 2.—*Showing the Temperature Found at the First Examination of the Patients*

Temperature in Degrees Fahrenheit	Number of Patients
Below 99.0	126
99.0 to 99.9	148
100.0 to 100.9	70
101.0 to 101.9	63
102.0 to 102.9	29
103.0 to 103.9	11
Above 104.0	2

TABLE 3.—*The Total White Blood Cell Count at First Examination of the Patients with Acute Appendicitis*

Total Leukocyte Count	Number of Patients
Below 11,000	125
11,001 to 15,000	111
15,001 to 18,000	70
Above 18,000	143

VARIATIONS IN THE COURSE

The need for alertness and freedom from preconceived ideas regarding the alleged typical onset of appendicitis is strikingly illustrated by Table 4, which lists the presenting symptom in some of the cases which had ruptured before surgery. In each of these cases, emphasis on the presenting symptom led to delay in making the correct diagnosis. The clinician should also bear in mind the cases reported by Mastin[4] in which pain was referred to the shoulder and clavicle. We did not happen to encounter this symptom in our series. (Table 4.)

TABLE 4.—*Unusual Presenting Symptoms Encountered in Our Series of Cases. In Each of These Cases, Emphasis on the Presenting Symptom Had Led to Delay in Making the Correct Diagnosis of Acute Appendicitis.*

Presenting Symptom	Number of Patients
Chill	2
Convulsion	2
Pain in right flank	11
Pain in right lumbar region	3
Pain in left upper quadrant	1
Pain simulating ureteral colic	1
Pain in testicle	1
Dysuria	6
Urinary frequency	3
Pain along outer surface of thigh	1
"Gas" and belching	4
Severe diarrhea	5
Obstinate constipation	2
Anorexia	1

TABLE 5.—*Location of the Appendix in the Patients of This Series. It Should Be Observed that by No Means All the Appendices Listed in the Right Iliac Fossa Were Found Even Approximately Under the Point Described by McBurney. The Three Listed as of Unknown Location Occurred in Patients in Whom Operation Was Limited to Drainage of Appendiceal Abscesses.*

Location of the Appendix	Number of Patients
Right iliac fossa	300
Retrocecal	119
Pelvic	22
Right upper quadrant of abdomen	1
Left upper quadrant of abdomen	1
Sac of right inguinal hernia	3
Unknown	3

A fertile source of error is the complaint of pain and the finding of tenderness at points other than in the right lower quadrant. Pain and point tenderness may occur over the inflamed appendix, wherever it lies—and the appendix may be found in many places within the abdomen other than directly under the point described by McBurney, and even outside of the abdomen, in hernial sacs. In one of our cases, the pain and point tenderness were in the upper left quadrant, and so was the gangrenous appendix. In three others, acutely-inflamed appendices were found in the sacs of right inguinal hernias, two in infants and one in an elderly woman. We have discussed the problem of hernial appendicitis elsewhere[5]. It is enough to say here that this diagnosis must be thought of in every case of supposedly strangulated hernia, especially if the symptoms are in any respect atypical. (Table 5.)

The retrocecal and the pelvic appendix are other traps for the unwary. The former may initiate symptoms likely to be confused with disease of the kidney, ureter, gall bladder, or thoracic organs. Soreness in the right flank, or even the right costovertebral angle, is the only sign in not a few cases where the eppendix lies behind the cecum. At times, especially in the obese subject, there will be an almost total absence of physical findings. In such cases one should be on the lookout for an inflamed appendix nestling under the protection of a thick, fatty omentum, either behind or at the side of the cecum. The inflamed pelvic appendix may be overlooked entirely, or it may be confused with disease of the ureter, bladder or genital organs. In many of these cases, diarrhea and rectal tenesmus will be the only complaints. It is shocking to note, when studying a group of histories, how frequently rectal examination is omitted. This simple procedure frequently elicits the only objective sign of an inflamed pelvic appendix. Rectal examination should never be omitted in any patient with an abdominal complaint, or indeed in *any* physical examination. In this connection a study of Brunn's[6] paper is recommended. (Table 6.)

INCIDENCE ACCORDING TO SEX

Although acute appendicitis is said to occur more frequently in males, our series agrees with that of Sengstacken[7] in showing a slight majority of females. There were 237 females and 212 males. Despite the fact that disease of the female pelvic organs offers greater opportunity for confusion in diagnosis, a larger number of the ruptured cases occurred in males, the proportion being 31.6 and 24.9 per cent respectively for males and females. (Table 7.)

TABLE 6.—*Distribution of the Patients with Acute Appendicitis According to Age and Sex*

	Age in Years									
Sex	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	Unknown
Male	20	51	45	17	24	19	12	8	0	6
Female	18	70	72	22	22	12	10	10	1	0
Total	38	121	117	49	46	31	22	18	1	6

AGE INCIDENCE

While it is true that acute appendicitis occurs most frequently in persons between the ages of ten and thirty years, no period of life is exempt. There were eleven females and eight males past seventy years of age in this series. All the females and five of the males had ruptured appendices. It is admittedly more difficult to make the diagnosis in the elderly. Often the onset is subacute. Pain, nausea

TABLE 7.—*Distribution of the Patients with Ruptured Appendices According to Age and Sex*

	Age in Years									
Sex	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	Unknown
Male	7	15	11	7	8	12	4	5	0	1
Female	11	10	6	7	5	5	4	10	1	0
Total	18	25	17	14	13	17	8	15	1	1

and vomiting, and rigidity are frequently absent. In many cases there are only generalized abdominal soreness and increasing constipation. Elderly patients frequently do not show the typical leukocytic response to infection, or any marked rise in temperature. Too frequently, signs of general peritonitis or a localized abscess give the first clue to the nature of the illness. Lazarus[8] is one of the recent writers to discuss this problem.

The young child also may tax the skill of the most capable diagnostician. Maes and coworkers[9] found that only 27 per cent of 250 children with appendicitis entered the hospital with their disease in the simple acute or acute suppurative stages. In our series there were thirty-eight children under ten, twenty boys and eighteen girls. In seven of the boys and eleven of the girls rupture had occurred. Two of our children had convulsions at the onset. In two others a violent chill was the initial symptom. Anorexia, colicky pains occurring intermittently and not localizing until very late, diarrhea, and general irritability, were other ways in which the infection was first manifested. We twice encountered temperatures above 104 degrees Fahrenheit. Leukocyte counts above 20,000 were not uncommon. Nixon and Nixon[10] and McClure[11] discuss the diagnosis of juvenile appendicitis and its special problems.

OTHER FACTORS

McKenna[12] emphasizes the importance of obtaining a sequential history in all cases of intra-abdominal disease. He also calls attention to Wilkie's belief that obstructive appendicitis is usually initiated by violent cramps, followed by nausea, vomiting, and repeated colicky attacks, whereas the acute inflammatory type most frequently has its onset with symptoms of malaise and without sharp pain. Such differentiation, however, is largely academic. Even if one could always be sure that the patient's symptoms were due to obstruction by a fecalith rather than to actual inflammation, it should be realized that the former is potentially just as dangerous. Indeed, perhaps a majority of ruptured appendices will show either a fecalith present, or signs of necrosis due to pressure by such a foreign body.

Although our records, especially in the earlier cases, do not contain notations regarding the presence or absence of skin tenderness in a sufficient number of cases to make it worth while to include this datum in the tables, we believe it to be a helpful finding in a certain percentage of cases. We agree with Livingston[13] that skin tenderness in the right lower quadrant will more frequently be elicited by vigorous stimulation than by the light stimulation used by Cope[14] and others.

AUTHORS' STATISTICS

It is no particular credit to us to have made a correct preoperative diagnosis in four hundred, or 89.1 per cent of the cases reported, and to have suspected the diagnosis strongly enough to operate for appendicitis in another thirty-three or 7.3 per cent, in view of the fact that so many of the patients were seen in consultation in advanced stages of the disease. The remaining 3.6 per cent, in which operation was performed under other diagnoses are instructive, however. In addition to the three cases thought to have strangulated hernias, another three patients were believed to have acute cholecystitis, two were thought to have salpingitis, two tuberculous abscesses, and two intestinal obstruction. One was diagnosed as having ruptured peptic ulcer, one a large ovarian cyst, one a tubal pregnancy, and one was at first believed to have colitis. In short, appendicitis may at times be confused with practically every acute disease within the abdomen.

IN CONCLUSION

In this connection we wish strongly to defend the diagnosis of "acute surgical abdomen," and the logically following exploratory operation. Skillful as the diagnostician may be, he will inevitably find an occasional case in which a specific diagnosis is not possible. It is rare, however, that he cannot in good conscience say that *something* is wrong in the belly. Too much time should not be lost in study or in waiting for definite localizing symptoms. Fewer deaths will result from occasional unnecessary laparotomies than from over-cautious delays which allow acutely inflamed appendices to rupture.

SUMMARY

1. A series of 449 consecutive cases of acute appendicitis is analyzed with respect to diagnostic problems.

2. The disease occurred in this series more frequently in females than in males. Although most common in the second and third decades, it was encountered in all age groups up to and including the ninth decade.

3. The percentage of cases ruptured when first seen by the surgeon was highest in the very young and very old, indicating the necessity for unusual care in studying abdominal complaints in these age groups.

4. No one symptom or sign occurred in every case.

5. Comparatively few patients showed the usual history of onset and physical findings described in the textbooks. Many exhibited some of the classical symptoms and signs. A surprisingly large number showed almost none of them.

6. Unusual symptoms of onset seen in this series included: chills, convulsions, dysuria, frequency of urination, pain resembling ureteral colic, pain in testicle, pain along outer surface of thigh, diarrhea and "gas."

7. The physician must not allow himself to be misled by atypical location of point tenderness and rigidity, or by their absence. These signs occur when peritoneum is irritated by an inflamed appendix, wherever it may lie—and the appendix may lie anywhere in the abdomen or even out of it, in a hernial sac.

8. Absence of point tenderness or rigidity should call to mind the possibility of a retrocecal or pelvic appendicitis.

2120 Fourth Avenue.

REFERENCES

1. Burger, T. O.: The Appendicitis Problem, California and West. Med., 25:38, (July) 1926.

2. Reid, M.: Editorial, The Appendicitis Problem, Surgery, 3:601, (April) 1938.

3. Finney, J. M. T., Jr.: Appendicitis: Some Observations Based on Review of 3,913 Operative Cases, Surg., Gynec., and Obst., 56:360, 1933.
4. Mastin, E. V.: Shoulder and Clavicular Pain in Appendicitis, Ann. Surg., 103:773, (May) 1936.
5. Burger, T. O., and Torbert, H. C.: The Diagnosis of Acute Hernial Appendicitis, Am. J. Surg., to be published.
6. Brunn, H.: Acute Pelvic Appendicitis, Surg., Gynec., and Obst., 63:583, (Nov.) 1936.
7. Sengstacken, R. F.: Appendicitis in the Small Hospital, Surg., Gynec., and Obst., 63:438, (Oct.) 1936.
8. Lazarus, D.: Appendicitis in the Aged, M. Rec., 144:410 (Nov. 4) 1936.
9. Maes, U., Boyce, F. F., and McFetridge, E. M.: Acute Appendicitis in Childhood, etc., Surg., Gynec., and Obst., 58:32, (Jan.), 1934.
10. Nixon, S., and Nixon, B.: Acute Appendicitis in Children, Am. J. Dis. Child., 51:1296, (June) 1936.
11. McClure, W. B.: Effects of Acute Appendicitis and of Lobar Pneumonia on Thoracic and Abdominal Respiratory Movements in Children, Am. J. Dis. Child., 52:1047, (Nov.) 1936.
12. McKenna, H.: The Reduction of the Increasing Mortality and Morbidity in Acute Appendicitis, Ann. Surg., 104:617, (Oct.) 1936.
13. Livingston, E. M.: The Skin Triangle of Appendicitis, Arch. Surg., 13:630, (Nov.) 1926.
14. Cope, Z.: The Early Diagnosis of the Acute Abdomen, New York and London, The Oxford University Press, ed. v, p. 57, 1930.

DISCUSSION

E. H. EISKAMP, M. D. (408 Main Street, Watsonville).—It has been a pleasure to discuss the paper of Doctors Burger and Torbert. It shows well-kept case histories and careful analysis of their findings, which are of great value to all of us. It is impossible to add anything to such a paper; however, there are certain things which I should like to emphasize.

I feel that in every patient with abdominal cramps without diarrhea the appendix must be eliminated, as it is the most common lesion of the intestinal tract. As one speaker stated, there is no one symptom or series of signs and symptoms necessary for the diagnosis of appendicitis, but we have felt the most important diagnostic point was midline abdominal cramps, followed by localized tenderness in the abdomen. The abdominal cramps may be high or low in the abdomen and may be referred to by the patient as cramps, gas, distress or aching, but he will usually state that moving or pressure does not aggravate them and often helps. After the localized tenderness arrives he may not recall them until he has been carefully questioned. The tenderness or soreness may be anywhere in the abdomen, depending on the location of the appendix. Regardless of the location of the tenderness, if preceded by abdominal cramps, we feel that we are probably dealing with an appendix. I feel that a rectal examination is of great importance, especially in children.

We feel that a pain beginning in the right side is probably not of appendiceal origin, unless a localized abscess of the appendix has ruptured, when careful history will usually tell of a preceding attack. Blood in urine is always a disturbing finding, but we have found it on some occasions. The white blood count is always very helpful if it shows a leukocytosis and an increase of polymorphonuclear, but is often absent, especially in fulminating appendicitis. We have found the Schilling index to be of some help in this type of case.

In the very early cases the appendix will appear normal to macroscopic examination, except for slight catarrhal inflammation of the mucosa at the point where it is kinked or a fecilith lies. If one is careful not to clamp the appendix itself, these early gross changes are not obscured.

❦

JOHN HOMER WOOLSEY, M. D. (Woodland).—Every statement in this paper is true, and discussion could well consist of the advice—study it, digest it, and do it. Failure to diagnose promptly and correctly is the physician's side of the problem. The opportunity for two or more able physicians to see the patient, as provided at a hospital or in group practice, does much to alleviate this. Consultation early and more often by the single practitioner is advisable.

The classical history is not always present before surgical treatment, but after the patient is over the attack and he can think more logically, it is surprising how classical the history often becomes. Not infrequently we hear the opinion given, "He has appendicitis and we are watching him carefully." This is illogical thinking, for none of us can be certain of the stage of inflammation; and if the diagnosis is made, then for the safety of the patient, prompt and proper surgical care should be employed.

Pain is the common symptom and of greatest significance. In the elderly and the very young the nervous system is not as well organized and coördinated and the complaint may be not as classical. In the elderly the circulation is not as adequate and gangrene ensues much earlier. Fever is of no significance in relation to treatment. Never wait for fever before employing the only proper treatment—surgery. Local muscle spasm and tenderness is dependent to the main extent upon irritation of the parietal peritoneum and so an inflamed appendix entirely separated from the parietal peritoneum may have no muscle spasm and but little tenderness. The pelvic appendix is the most difficult type to recognize. As the author advises, read Brunn's excellent article. The white blood count is more misleading to the profession, as a whole, than any other index. Make your diagnosis before this information is at hand, and look upon it as an index as to the degree of protective response on the part of the patient.

Not every abdominal pain means appendicitis; but when the evidence is indicative of continued intra-abdominal inflammation act promptly, for a life is at stake. We do not recommend unnecessary or ill-advised surgery, but when the evidence is adequate prompt surgery is in order, and if necessary the preoperative diagnosis of "acute surgical abdomen" may at times have to be accepted.

❦

DOCTOR BURGER (Closing)—In closing the discussion, I wish to thank all those who have participated. The contrast in mortality in this small group of cases was so marked that it seemed to us worth while to attempt to point out some of the pitfalls which led referring practitioners into delaying diagnosis until the appendix had ruptured.

May I repeat, a strikingly large number of ruptured appendices in our series occurred in very young and very old patients, and in persons where the organ was either retrocecal or protected by a large, fatty omentum. The physicians in very many of these cases failed to diagnose appendicitis "because there was no rigidity," or "no point tenderness at McBurney's point." Our tables are worth studying, and indicate how few cases showed all the findings of the so-called textbook picture. If the newer generations of doctors are ever to improve their diagnostic percentage in this disease, the picture embalmed in present-day surgical textbooks is going to have to be drastically modified, to conform more closely with the facts of real life.

Dr. Homer Woolsey's auscultation of the abdomen, which he so convincingly presented this afternoon, was not practiced by us in this series of cases, but he may be sure that we shall avail ourselves of this diagnostic aid in studying our next ten-year series of cases.

RADIATION THERAPY IN ACUTE AND CHRONIC INFLAMMATORY CONDITIONS*

By HENRY JOHNSON ULLMANN, M.D.
Santa Barbara

DISCUSSION *by Robert S. Stone, M. D., San Francisco; Frederick H. Rodenbaugh, M. D., San Francisco; Orville N. Meland, M. D., Los Angeles.*

THE title of this paper is misleading, as the intention was to cover inflammations due to infections, since these are the conditions usually benefited by properly applied irradiation. Stress will be laid on the commoner forms seen almost daily in practice and in which irradiation produces

* Read before the Radiology Section of the California Medical Association at sixty-seventh annual session, Pasadena, May 9–12, 1938.